Citation:

Diehr P, Bild DE, Harris TB, Duxbury A, Siscovick D, Rossi M. Body mass index and mortality in nonsmoking older adults: The Cardiovascular Health Study. *Am J Public Health.* 1998 Apr; 88(4): 623-629.

PubMed ID: 9551005

Study Design:

Prospective Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To assess the relationship between body mass index (BMI) to five-year mortality in a cohort of non-smoking men and women aged 65 to 100 years.

Inclusion Criteria:

- Non-smoking women and men aged 65 years and older at baseline
- Not institutionalized
- Expected to remain in the area for the next three years.

Exclusion Criteria:

Persons who were:

- Wheelchair-bound
- Receiving hospice treatment, radiation therapy or chemotherapy for cancer at baseline.

Description of Study Protocol:

Recruitment

Participants were recruited from a random sample of the Health Care Financing Administration Medicare-eligibility lists in four US counties.

Design

Cohort study.

Statistical Analysis

- All analyses were performed separately for men and women. First examined was the bivariate relationship of each covariate with mortality, controlling for age in a logistic regression model. Also examined were relationships of covariates to BMI, using least squares regression to adjust for age
- Since all subjects were followed up for five years, five-year mortality was used as the dependent variable
- The results are presented as adjusted mortality rates, which were calculated from two logistic regression models, one controlling only for age and the other controlling for all of the covariates. Both models are presented because of the possibility of over-adjustment" (controlling inappropriately for factors that may have been affected by the person's weight)
- Adjusted mortality was calculated as observed mortality minus predicted mortality (from regression) plus the overall mortality (0.083 for women or 0.177 for men). The mean of this variable, for a group of subjects, is the adjusted mortality for that group, which is shown in the tables
- The standard errors for the adjusted rates are not shown, but are approximately the binomial standard error. Age-adjusted BMI was computed in a similar manner, using least squares regression. To lessen the effect of BMI outliers on the regression analyses, BMI was Winsorized, with all values below the fifth percentile set to the fifth percentile and all values above the 95th percentile set to the 95th percentile
- For some analyses BMI was divided into two-unit categories. The highest and lowest categories were widened to provide a minimum of 100 persons per category. Logistic regression was used to test formally whether the relationship of mortality to BMI was linear or quadratic
- Covariates were entered first, then BMI, then BMI^2. To test whether the highest or lowest BMI categories had risks different from the others, researchers tested whether dummy variables for those BMI categories made significant improvements to the regressions. To study the role of long-term weight loss, some regressions were performed excluding people who had lost more than 10% of their body weight since age 50. In addition, subjects were divided into three equal groups based on their BMI at baseline and used the same cutoffs for their BMI at age 50
- Mortality cross-tabulated by BMI at age 50 and at baseline was examined. Also conducted were logistic regressions of baseline BMI vs. mortality within the three BMI at age 50 subgroups
- To assess the comparability of the Cardiovascular Health Study sample to the US population, the distribution of BMI at baseline was compared with national data for ages 65 through 74 and compared with the distribution of BMI at age 50 with national data for ages 45 through 55.

Data Collection Summary:

Timing of Measurements

- Five-year follow-up
- Data collected at baseline and at age 50.

Dependent Variables

Five-year mortality.

Independent Variables

BMI.

Description of Actual Data Sample:

- *Initial N:* 5,201
- *Attrition (final N):* 4,317
- *Age:* 65 years and older
- *Location:* Four US counties.

Summary of Results:

Age-adjusted Mortality in Non-smoking Older Adults, by BMI at Baseline and at Age 50: The Cardiovascular Health Study, 1996

Baseline BMI	Low (≤24.12kg/m^2)		Medium (24.12 to 27.96kg/m^2)		High (>27.96kg/m^2)			
	Mortality		Mortality		Mortality		Total	
Women								
Low	653	7.8	111	6.7	23	25.4	787	8.1
Medium	347	7.3	362	7.0	70	16.7	779	8.0
High	77	8.8	357	6.8	321	10.2	755	8.4
Total	1,077	7.7	830	6.9	414	12.1	2,321	8.2
Men								
Low	427	13.7	158	29.4	37	36.9	622	19.0
Medium	193	14.1	312	14.2	113	27.6	618	16.6
High	58	20.9	204	12.2	348	17.0	610	15.8
Total	678	14.4	674	17.1	498	20.9	1,850	17.1

Author Conclusion:

Overweight does not seem to be a risk factor for five-year mortality in this age group. Rather, the risks associated with weight loss should be the primary concern.

Reviewer Comments:

None.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	N/A
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	N/A
1.3.	Were the target population and setting specified?	N/A
2.	**Was the selection of study subjects/patients free from bias?**	No
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	No
2.2.	Were criteria applied equally to all study groups?	N/A
2.3.	Were health, demographics, and other characteristics of subjects described?	No
2.4.	Were the subjects/patients a representative sample of the relevant population?	N/A
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	???

3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	No
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	No
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	No
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	Yes
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes

6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	Yes
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	N/A
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	No
7.7.	Were the measurements conducted consistently across groups?	N/A
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	No
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes

9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes